



# A BRIEF REVIEW OF THE WETLAND FUNCTIONAL ASSESSMENT FOR THE PROPOSED DONLIN MINE PROJECT AREA

By NatureServe

September 11, 2014



Authors:

Gwen Kittel, Regional Vegetation Ecologist, Western Regional Office, Boulder, CO  
gwen\_kittel@natureserve.org, 703-797-4812

and

Don Faber-Langendoen, Senior Research Ecologist, Syracuse, NY

don\_faber-langendoen@natureserve.org, 703-908-1816

NatureServe, Home Office

4600 N. Fairfax Dr., 7th Floor

Arlington, VA 22203

Tel: 703-908-1800

Fax: 703-229-1670

## Contents

Introduction .....	1
Background .....	1
Review of 3PPI Method.....	4
The Magee Rapid Functional Assessment Approach .....	4
Overview .....	4
Estimating wetland functions .....	6
Wetland condition and wetland functions .....	7
Missing functions and important indicators: .....	8
Missing links between measured variables and functions .....	9
Representation of full wetland diversity and potential loss .....	11
Assessing project impacts .....	13
Suggestions for Improvement.....	15
Literature Cited .....	17

## **Introduction**

EPA requested a review of the Wetland Functional Assessment for the proposed Donlin Gold Mine in southwestern Alaska, conducted by the resource consulting firm Three Parameters Plus, Inc. (3PPI 2014). The request is to focus on the methods (chapter 2) of the report with an emphasis on the resulting outcome, namely how the resulting overall debits and credit calculation that will affect mitigation. Funding for this review was provided by U.S. Environmental Protection Agency under EPA contract EP-W0-07-080.

This request came to NatureServe on August 18<sup>th</sup>, 2014, with a deadline for deliverables set at September 11, 2014. With this quick turn-around in mind, the following report is not a full review of the entire Wetland Functional Assessment document. In this report, we provide a discussion of method limitations and suggestions for improvement.

## **Background**

In their report to Donlin Gold “Draft Wetland Functional Assessment – Donlin Gold Project, June 2014 (v02, r01)”, 3PPI describes the propose mine location in Southwest Alaska as ~10 miles (16 km) north of the Middle Kuskokwim River village on Crooked Creek and approximately 277 miles (446 km) west of Anchorage, Alaska. The Donlin Gold Project comprises a wetland study area of approximately 331,881 acres (134,308 hectares [ha]).

The wetland functional assessment was completed both in what is called the Facility Study Area (FSA), including the main mine area and transportation corridors, and the Pipeline Study Area (PSA), an approximately 315 mile (507 km) long, 2,000 foot–wide (or more) corridor that starts about 4 miles (7 km) east of the FSA exploration camp and continues through the Alaska Range to Cook Inlet near the tiny village of Beluga, and includes an approximately 100-foot–wide (30 meter [m]) pipeline infrastructure.

According to the report, the Donlin Gold project footprint is expected to have several kinds of impacts to the landscape, including “those impacts that will require fills and the types and

depths of those fills, areas that will require excavation and areas that will require clearing of large woody materials and/or shrubs but otherwise leave the soil surface undisturbed.” In addition, 3PPI categorized the duration of impacts as either temporary or permanent.

The report documents the functional assessment (FA) methodology used to quantify impacts to wetland functions from the proposed Donlin Gold project and presents the results. As described by 3PPI, a quantitative Functional Assessment (FA) “is the process by which the capacity of wetlands to perform a specified function or functions is measured. The approach used for the Donlin Gold project measures capacity using assessment models to determine a functional capacity index (FCI) for each type of wetland. The FCI is then converted to an area-based unit known as a functional capacity unit (FCU). The FCU value is derived by multiplying the FCI for a wetland area by the size of the wetland. The FCU then forms the basis for a wetland debit or credit analysis.”

The goal of completing the FA is that wetlands that require mitigation are replaced with wetlands of similar function. Thus, ideally, there is a function to function replacement. This reduces the potential that a mitigation plan inadequately compensates for lost function by masking low scores with high scores in another attribute.

3PPI states at the outset that there are limitations to their FA approach, which is derived from the hydrogeomorphic (HGM) approach of Brinson (1993, see also Smith et al. 1995). They note that the HGM approach has three essential elements:

- Classification of wetlands into HGM wetland classes.
- Establishment of reference and reference standard wetlands for each wetland class.
- Building of assessment models based on data collected from the set of reference wetlands. The models lead to a numerical index that represents the capacity of a wetland to perform a specific function (e.g., storm and floodwater storage).

Their HGM approach is limited because “a full HGM procedure...is not practical for very large projects such as the Donlin Gold project.” Further, they note that “regionalized HGM models do not currently exist for all the HGM classes evaluated across the project area, and new models typically take 3 to 4 years to develop.” Instead, they note that “Rapid assessment methods have been developed to provide a scaled-back procedure while still relying on the sound principles of HGM classification and identification of wetland functions across a project area. One of these procedures, as described in *A Rapid Procedure for Assessing Wetland Functional Capacity: Based on Hydrogeomorphic (HGM) Classification* (Magee and Hollands 1998), served as the basis for the wetland FA in the Donlin Gold project area. This method (termed herein as the Magee rapid FA method) is a standardized approach used to assess the capacity of a wetland to perform eight functions.”

In following the HGM approach, “the Magee rapid FA method requires that the wetlands in a project area be classified by HGM class (Brinson 1993, Smith et al. 1995). Six standard HGM classes (riverine, slope, depressional, flats– mineral soil, flats– organic soil, and lacustrine fringe) are found in the [study area]. Because the two types of flats classes (mineral soil and organic soil) function similarly and are difficult to distinguish in the mapping of large project areas, they were combined into a single flats class that resulted in the use of five standard HGM classes for the Donlin Gold project.”

Eight wetland functions are estimated by the Magee rapid FA: groundwater discharge, groundwater recharge, storm and floodwater storage, stream flow, water quality, export of detritus, wetland vegetation, and wetland fauna. The eight functions fall into four categories: hydrology, biogeochemistry, plant community, and faunal habitat support. As is common with FAs, wetland functions for the Magee rapid FA are derived from field or remote sensing measures based on structure and composition variables: thirty separate variables were recorded on data forms for each project site. The variables fall into four categories: hydrologic, vegetation, soil, and landscape. The variables enabled use of a scoring system to derive the FCI—the numerical value that represents the ability of a wetland to perform a function relative

to other wetlands of the same HGM class in the project area. The FCI represents the capacity of the wetland to perform a function relative to the maximum degree that is possible, and is calculated by scoring each variable from 1 (highest capacity to perform a function) to 0 (no capacity).

Typically, WFAs are completed using field-based assessments of the variables. Given the size of the Donlin Gold Project, over 300,000 acres, it was not possible to conduct a field inventory of each wetland polygon. Thus a GIS based approach was used, where wetland information was photo-interpreted, and polygons were labelled, so that scores for variables assigned to wetlands with field data could be assigned to wetlands with no field data. In this way a comprehensive set of functions could be established for the entire study area.

## **Review of 3PPI Method**

### **The Magee Rapid Functional Assessment Approach**

#### **Overview**

We briefly comment on a few general issues regarding the Magee rapid FA method. First, we agree with the authors that a full HGM is not always needed and that a suitable rapid assessment method may serve to address many of the needs of wetland assessments. Still, a rapid assessment method needs to be validated. Although the report cites extensive use of the method, including previous projects by 3PPI, none of these appear to be studies that validate the rapid method. This is of some concern because, as the report notes “The Magee rapid FA method (Magee and Hollands 1998) was originally written for use on wetlands of the glaciated northeast and Midwest.” We are not aware of it currently being in use in the glaciated Northeast and Midwest, nor how it may have been tested and validated in that region or in Alaska.

The report goes on to say that “the method may be used as an example of a rapid assessment procedure, modified to make it applicable to other regions, or refined for specific subregions by

adding, deleting or modifying the functions, variables, and variable conditions or by making other changes appropriate for the specific location.” The decision making process for making the method appropriate for a specific location needs better explanation.

It is not clear how the Magee rapid FA method draws from the various regional HGM publications that are available for Alaska (Lee et al. 1999, Powell et al. 2003, Hall et al. 2003). Several distinctive aspects of the HGM approach used in report seem to differ from these guidebooks. First, the authors lump the mineral and organic flats HGM classes. The authors do not explain why they consider the mineral and the organic soil classes to function similarly. Mineral soils flats are most common on interfluves, extensive relic lake bottoms, or large historic flood plain terraces where the main source of water is precipitation, whereas Organic soil flats , or extensive peatlands, differ from mineral soil flats , in part because their elevation and topography are controlled by vertical accretion of organic matter (Smith et al. 1995). Peatlands might be expected to function quite differently from mineral soils. It would be helpful to know how common each of these classes are from field observations, to understand the effects of lumping these two classes on assessing wetland function.

Another feature of one of the HGM guidebooks is the expanded role of forested versus shrub and herb types in assessing function. For example Lee et al. (1999, Table 23) clearly assign different functional values to forested vs non-forested sites. Below is an excerpt from Table 23.



**Except from Table 23—Reference Standard Conditions for Precipitation-Driven Wetlands on Discontinuous Permafrost in Interior Alaska (Lee et al. 1999).**

Variable	Reference Standard Condition
V <sub>AQUIC</sub> :	Direct observation of aquic soil conditions and/or evidence of aquic conditions from morphological characteristics indicative of saturated soils in the modal soil profile. Aquic conditions have not been altered by human-induced disruption of the soil profile or thermal regime.
V <sub>AREAUSE</sub> :	Site undisturbed. No significant human-induced alterations.
V <sub>CONTIG</sub> :	Assessment area is connected to adjacent areas through contiguous native plant communities along 100% of its perimeter. Plant communities must extend at least 100 feet beyond the assessment area boundary.
V <sub>CWD</sub> :	<b>Forested Community Type:</b> <u>Burned 0 - 5 years ago:</u> > 3023 pieces/acre (density) and/or > 1781 cu. ft./acre (volume) <u>Burned 6 - 30 years ago:</u> ≥ 545 pieces/acre (density) and/or > 90 cu. ft./acre (volume)
V <sub>HERB</sub> :	<b>Forested Community Types:</b> <u>Burned 0-5 years ago:</u> >26% CC and/or Site unaltered by humans and dominated by native plant species <u>Burned 6-30 years ago:</u> >26% and < 75% CC and/or Site unaltered by humans and dominated by native plant species <u>Burned &gt;30 years ago or if no evidence of burn:</u> ≤50% CC and/or site unaltered by humans and dominated by native plant species <b>Shrub Community Type:</b> 6-75% CC and/or site unaltered by humans and dominated by native plant species <b>Sedge Tussock Community Type:</b> >50% CC and/or site unaltered by humans and dominated by native plant species

All this said, the Magee rapid FA method may currently be an acceptable industry standard for Alaska, and there may be more interaction with the authors of the HGM guidebooks than is provided in this report.

### **Estimating wetland functions**

The report provides a summary of how the eight wetland functions were assessed (see Table 2.2-6). The formulas are part of the standard HGM approach, but here again there is no indication that these equations have ever been validated. In the portion of Table 2.2.-6 shown below, how does the user know that there is a good relationship between export of detritus and the various variables that are put together? This is a general concern raised about HGM functional assessments in general, even those based on more intensive HGM methods (Cole 2006), and may be of particular concern where a rapid method is developed to use these same kinds of equations.

**Except From Table 2.2-6. Magee rapid FA Scoring System Converted to Formula Expressions.**

<b>Biogeochemistry</b>	
6. Export of Detritus	$FCI = (V_{wetuse} + V_{out} + V_{inout} + V_{regm} + V_{vegden} + V_{soil}) / 18$ for depressional and flats wetlands. $FCI = (V_{wetuse} + V_{inout} + V_{regm} + V_{vegden} + V_{soil}) / 15$ for slope wetlands. $FCI = (V_{wetuse} + V_{regm} + V_{vegden} + V_{soil}) / 12$ for lacustrine fringe and riverine wetlands.
<b>Plant Community</b>	
7. Contribution to Abundance and Diversity of Wetland Vegetation	$FCI = (V_{divers} + V_{vegden} + V_{juxta}) / 15$ for all HGM classes.

### Wetland condition and wetland functions

We concluded briefly by noting that increasingly wetland assessments include both the wetland's ecological condition or integrity and its functions (Fennessy et al. 2007). Stevenson and Hauer (2002) already suggested the merits of considering both perspectives for wetland mitigation purposes. One of the merits of condition assessments is the integration of observable structural and compositional variables directly into both individual metric scores and an overall wetland condition score. Assessing wetlands function by function can “result in a group of scores for each site that makes it difficult to compare their relative ecological status, the extent of anthropogenic impacts, or to make statements about the health of the resource as a whole” (Fennessy et al. 2007).

In addition there is a concern that addressing function without considering ecological condition can be misleading. Fennessy et al. (2007) state: “Another concern is that in some functional methods, defining the highest level of a function does not necessarily equate with high ecological condition. Scoring by the highest degree of functionality can be a trap because maximizing one function (e.g., water quality improvement) may cause a reduction in others (e.g., supporting characteristic diversity) (Zedler 2005). Ultimately, if a wetland is functioning as an integrated system with a high degree of ecological integrity it will perform all of its characteristic functions at the full levels typical of its class (i.e., at the level of the reference condition).” These concerns highlight the need for reference sites, where estimates of wetland function are interpreted within the ecological parameters of the wetland type.

### **Missing functions and important indicators:**

The authors provide the list of 8 functions that they evaluated in Table 2.2-1, including groundwater discharge, groundwater recharge, storm and floodwater storage, stream flow, water quality, export of detritus, wetland vegetation, and wetland fauna. While the authors recognize similarity between other assessment methods and the Magee functions in Table 2.6-1, their functions are often aggregates. By lumping key functions together under a single “function” their calculation may underestimate the full functional value of the wetland under consideration. For example they place the Sediment Removal and Nutrient and Toxicant Removal functions within the function of Modification of Water Quality. They also lump General Habitat Suitability (from a wildlife perspective) and Native Plant Species Richness within the Contribution to Abundance and Diversity of Wetland Vegetation. It would be more transparent, and more like other functional assessments, to use standard terms and functions and not lump several of these functions under one category. Below we list functions used by other HGM assessments.

1. **Retention of Sedimentation** function (affected by surface microtopography, dead woody debris and standing live vegetation). This function relates to “Dissipation of Energy” and “Retention of Particulates” functions described by Smith et al. 1995, “Particulate Retention” by Powell et al. 2003, and “Particulate Retention /Toxicant Removal” by FAA 2007, “Retention of Sediments and Other Particulates” by Tiner 2005, “Sediment Retention” by Adamus et al. 2010.
2. **Maintenance of Plant Communities** function (Smith et al. 1995), Maintenance of Riparian Vegetation and Maintenance of Characteristic Plant Communities (Smith et al. 1995, Powell et al. 2003, Hall et al. 2003). This is not the same as the Magee wetland FA “Contribution to Abundance and Diversity of Wetland Vegetation” which scores high only for high density, highly diverse and well connected wetlands, which also does not assess the inherent variability of the wetland types that may be present (a naturally low diversity salt marsh vs. multi layered forest type).
3. **Maintenance of Animal Communities** function (Smith et al. 1995, Powell et al. 2003, Hall et al. 2003, Tiner 2005). This is not the same as the Magee wetland FA

“Contribution to Abundance and Diversity of Wetland Fauna” which only scores high for areas with high micro-topography, multiple layers, large size and interconnected wetlands, and nothing about what may be there naturally or prior to the proposed impact activity.

4. **Carbon Sequestration** Function (affected by cutting and removal of woody vegetation), (Smith et al. 1995, Powell et al. 2003, Hall et al. 2003, Adamus et al. 2010).
5. **Organic Carbon Export** Function (affected Cutting and removal of soils, woody vegetation) (Smith et al. 1995, Powell et al. 2003, Hall et al. 2003, Tiner 2005, Adamus et al. 2010). This is called Export of Detritus in the Magee wetland FA method, but does not capture the full impact of woody vegetation cutting on this function.
6. **Cycling of elements and compounds** Function (ability to filter and process mine runoff) (Smith et al. 1995, Powell et al. 2003, Hall et al. 2003, Tiner 2005, Adamus et al. 2010).
7. **Invasive Species** variable. If used by the Magee wetland FA method, it would affect the Contribution to Abundance and Diversity of Wetland Vegetation and Contribution to Abundance and Diversity of Wetland Fauna. It is used in the Maintenance of Characteristic Plant and Animal Communities, and affects Land Use scores and vegetation layer scores by Powell et al. (2003). It is used in the measurement or condition of Native Plants variable, part of the Maintenance of Characteristic Plant Communities Function by Hall et al. (2003). And it is used in the “Non-native aquatic animals” and “Submerged Aquatic Vegetation Invasives vs. Non-invasive cover” variables as described by Adamus et al. (2010).

#### **Missing links between measured variables and functions.**

The following is a review of variables and their applicable functions as shown in Table 2.2-2.

**pH (VpH) (#9).** Measurement is one reading, so it is not clear how it indicates modification of groundwater recharge or modification of stream flow. With a single reading it might be an indicator of groundwater discharge; with several readings that are spatially distributed, it could be an indicator as to how the wetland modifies the

water quality. Industry standard is to use pH as an indicator of Modification of Water Quality.

**Cover Distribution (VCover) (#16)**. The variable ranges from continuous cover to solitary stems. This variable is only attributed to Modification of Water Quality, but it can affect other functions through the physical effects of overland flow, including: Storm and Floodwater Storage, Modification of Stream Flow, and Export of Detritus. And Cover Distribution affects wildlife usage, so this variable also affects the Contribution to Abundance and Diversity of Wetland Fauna. The method correctly attributes Dead Woody Material (Vwood) to these functions; Cover Distribution (or live vegetation cover) has the same influence, if not more so. This appears to be an oversight of an industry standard, at least for fuller HGM methods, as vegetation cover is used as an indicator for Riparian Vegetation Maintenance Function (Powell et al. 2003), Sediment Retention, Cycling of elements and compounds, and Maintenance of Characteristic Plant Community functions (Hall et al. 2003).

**Dominant Wetland Type (Vtype) (#19)**. The type of dominant wetland also affects functions of Storm and Floodwater Storage, Modification of Stream Flow, Export of Detritus, and the Contribution to Abundance and Diversity of Wetland Fauna.

**Number of Layers (Vlayers) (#20)**. This variable needs to be applied differently for different wetland types. In addition the complexity of the vegetation influences the functions of Storm and Floodwater Storage, Modification of Stream Flow, and Export of Detritus.

**Number of Wetland Types (Vnum) (#21)**. The complexity of the mosaic of wetland types within a mapped polygon would also influence the functions of Storm and Floodwater Storage, Modification of Stream Flow, and Export of Detritus.

**Size (Vsize) (#28)**. The size of a wetland has a large effect on the ability of the wetland to filter and change water quality from inputs to the output; therefore it can be expected to have an important effect on the function of Modification of Water Quality.

**Watershed Land Use (Vsheduse) (#29).** Surrounding land use practices affect the amount of sediment and pollutants entering wetlands and effects the functions of Export of Detritus, and the Modification of Water Quality.

In addition, other HGM functional assessments use different variables based on the structure of the wetland type. For example Hall et al. (2003) has separate equations for Forested vs. Shrub and Herb dominated wetland types for Particulate Retention, Organic Carbon Export, Cycling Elements and Compounds, and the Maintenance of Characteristic Habitat Structure functions. The Magee wetland FA method does not account for the characteristic wetland types, nor does it adjust scores for the differences in community structure and its influence on functions. In the Donlin Wetland Assessment the authors use vegetation type for some function calculations, for example Water Quality, but do not use vegetation type for storm and flood water storage. Vegetation type appears to be inconsistently applied (see Appendix B, 3PPI 2014). These may be reflections of needing to keep the method a rapid one, where choices need to be made as to which functions can reasonable be addressed, but it also appears to be the way the method itself uses the available data to calculate the functions.

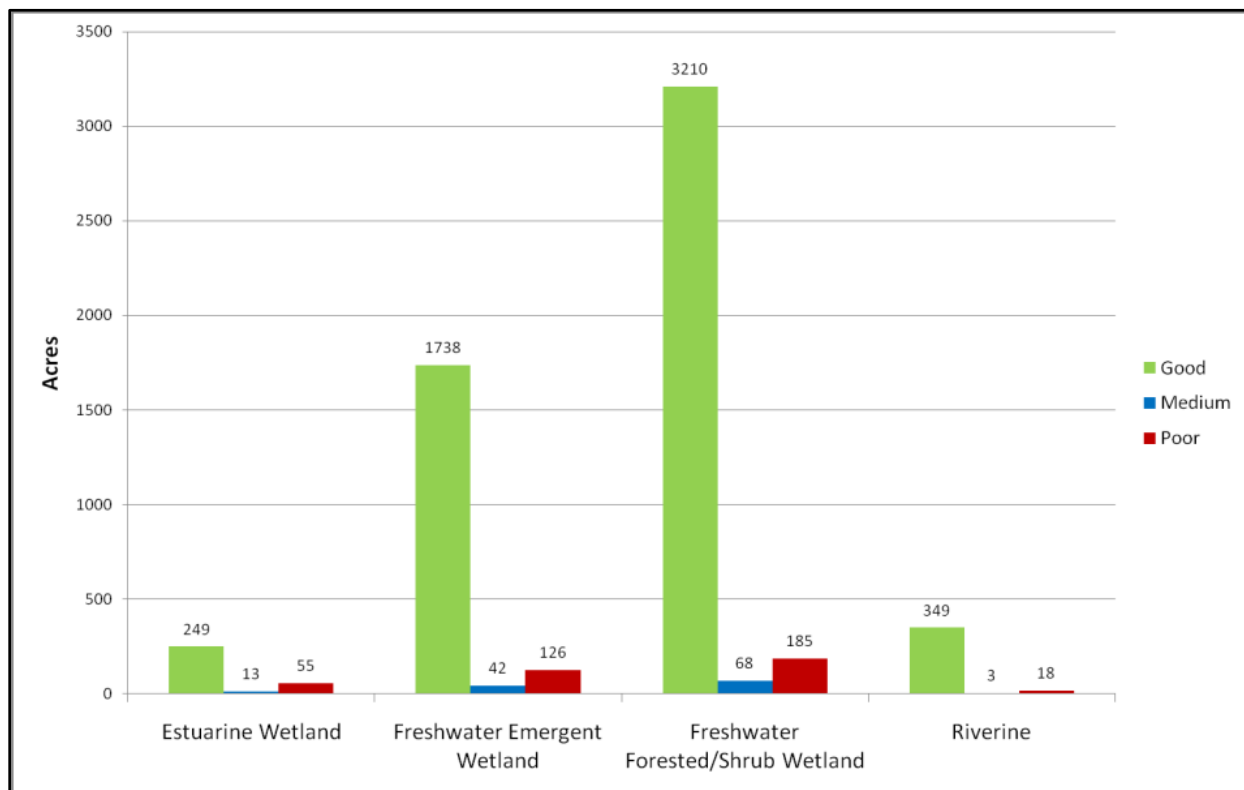
### **Representation of full wetland diversity and potential loss**

As noted above, the report does not distinguish between mineral flats and organic flats. In addition, the inclusion of various subclasses (i.e. vegetation types) could greatly enhance the scores, as not all subclasses function the same (e.g. Riverine: mineral flat vs. forested bank). How a riverine wetland would retain or export sediment or influence stream flow would differ considerably from a bare mineral flat vs. a forested polygon of riverine wetland. For example see Hall et al. (2003), where the “Particulate Retention” function (which has no equivalent in the Magee rapid FA method) and the “Maintenance of Characteristic Habitat Structures” function is scored differently for forested than for shrub and herbaceous communities.

Also, as noted earlier, the presentation of the wetlands in terms of functions can obscure basic wetland type and condition information. For example, it would be instructive to know what the current diversity and abundance of the various wetland classes, and their current condition.

This is sometimes referred to as a watershed profile. An example of a watershed profile is provided in Figure 1, and guides the user as to the range and condition of the wetlands.

**Figure 1. Example profile of the abundance of wetlands by NWI wetland type for the Juneau Watershed, with an ecological integrity assessment score (figure from Kittel and Faber-Langendoen 2011).**



It would be informative to know what wetland types are impacted by permanent loss and impacts that are non-permanent. For example, within the footprint of the open pit (FSA), there will be permanent loss of some wetlands. Knowledge of the HGM class and vegetation type that may be lost will provide additional information necessary for compensatory mitigation opportunities. Knowledge of the HGM and vegetation type for non-permanent impact will be important for appropriate mitigation and credits assigned as mitigation occurs after mine closure. This also ensures that restoring wetland functions is linked to the restoration of wetland types that comprise the area.

### **Assessing project impacts**

The impacts to wetlands from clearing woody vegetation and the related disturbances to the soil disturbance likely to happen over the course of the full pipeline length do not appear to be adequately captured in this assessment. The report assumes that vegetation clearing activities will have a limited impact on micro-topography, minimal changes to overall species diversity and minimal changes to understory species density. These assumptions do not appear to be correct. For herbaceous dominated communities, mowing of vegetation with heavy equipment can cause soil compaction, pocking, and rill formation if soils are wet at the time of the mowing activity. For woody dominated communities clearing overstory vegetation often influences the understory species density and composition with a release from competition and increases in the amount of sunlight. Many of these impacts may not occur, but when measuring for impacts that need to be compensated for through mitigation, these features are important in the functionality of wetlands, and should not be over looked.

Another assumption stated is that after 30 years of use, an area that was used as a non-permanent impact is expected to be fully mitigated, and returned to the functional wetland the area was prior to impact. The assumption is that on year 31 full credit for that “repaired” area can be given. While it makes sense to reduce debits for nonpermanent impacts, it does not make sense to assume full functions will return within the first year, more or less instantly. An addition of a ramp-up of credits over three years to come to full credit would be more in line with industry standards, and a recognition that mitigated wetlands rarely meet their full functional potential (Turner et al. 2001)

The adjustment for vegetation clearing impacts is inadequate. First the report acknowledges that some variables would likely change due to vegetation clearing such as Wetland Land Use, Number of Wetland Types, Proportions of Wetland Types, Interspersion of Vegetation Cover, Number of Layers, and Percent Cover of Layers, and states that none of these variables are



used in six of the eight Magee rapid FA method functions. So they compensate by reducing the FCI by 2 out of 12 variables, a loss of 16.7 percent. If we added back in the 7 variables listed above into the index, the reduction would be greater; a reduction by 7 variables of a total of 19 would result in a loss of 36.8%, more than doubling the reduction in credit.

The authors state that the Kuskokwim River, Crooked Creek, Jungjuk Creek, Getmuna Creek, and Bell Creek are listed and mapped as *Important for the Spawning, Rearing or Migration of Anadromous Fishes* by the State of Alaska (ADF&G 2013), yet no criteria for fishery habitat is included in the assessment that we are aware of.

Several federally and state listed and sensitive plant species were documented to occur within the footprint of the proposed mine project area. These are included as part of the Magee plant diversity function, but do not apparently count any higher than any other plant species in the calculation of total richness. The Magee rapid FA method seems to lack sensitivity to account for impact or loss of these federally and state designated special plant species.

Important land uses are documented as part of FSA and PSA, such as archeological areas, known subsistence uses (fishing, hunting, trapping, berry picking, and transportation corridors), however the value of these uses are not part of the functional assessment and are not included in the impact loss (debit) calculations. See Adamus et al. (2010) for a comprehensive functional assessment that includes a way to document these types of human values as part of a functional assessment.

While the document is a functional assessment of wetlands per se, we do wonder if it's appropriate to exclude the riverine channel from the baseline credit analysis, as stated in the footnote of Table 3.1-6 "Excludes 1,396.94 wetland areas mapped as HGM class riverine channel". Permits and mitigation are required for all potential negative activity in or near water bodies as well as surrounding wetlands, especially for riverine wetlands when discussing functions such as the ability to transport detritus, or anadromous fish habitat support (a

function that is not included in the Magee method). Section 404 of the Clean Water Act states “The law places the burden of proof squarely on a permit applicant to demonstrate that any particular dredge or fill discharge into any waters of the U.S. is (a) unavoidable and (b) the least environmentally-damaging practicable alternative to achieve the basic purpose of the project” and that any impact for activities that are conducted in or near water have “compliance evaluation procedures [that] will vary to reflect the seriousness of the potential for adverse impacts on the aquatic ecosystems posed by specific dredged or fill material discharge activities”—see sections 40CFR230.10(a) and 10(a)(3) (USCFR 2013).

### **Suggestions for Improvement**

1. Use Vegetation Map Codes listed on page F-3 as Subclasses to HGM (i.e. Broadleaf forests, Mixed forests, Shrub Types, Herbaceous Types, etc.). See Hall et al. 2003’s “HGM Regional Guideline for Slope/Flats in the Cook Inlet area of Alaska” for criteria and scoring on amount of woody cover, coarse woody debris, etc. that differ by Forested, Shrubland, or Herbaceous Community types.
2. Provide a full picture of the diversity, abundance, and condition of wetlands within the mine study area, such as a watershed profile (Figure 1). Show the amount in acres by HGM and wetland type. In order for mitigation to be effective and for the public to truly understand the full impact and loss of these wetlands, there needs to be a clear indication of the number of acres lost and impacted by the different HGM and community types present within the mine and supporting area and roads footprint, the pipeline footprint and a buffer area immediately surrounding these areas. This information needed for such an analysis has already been gathered by 3PPI, as all detailed mapping included vegetation classification codes. Indeed in sections 2.5.1.7 and 2.5.2.7 Regionally Scarce Wetland Category within the FSA and PSA, respectfully, notes are made as to which type of NWI wetlands are scarce. We suggest a full analysis of the abundance of all wetlands be cataloged by NWI, HGM and Vegetation Classification. This can be followed by an analysis of how this “profile” of wetlands will be altered by the Donlin project.

3. Consider adding additional functions, as commonly reported by other HGM methods (though perhaps those functions are only possible with a more intensive HGM?), and link more functions to the variables measured for a more robust calculation of the amount of debit (impact) likely to occur with this mine and support are installation. Or provide a clear documentation as to how the method adequately captures the core functions in the context of a rapid FA method.

4. Account for additional potential impacts to anadromous fish habitat, rare plant species, and important human use areas (current and historical) in the final calculation of impact (debits) of the mine. This should include the full downstream impact of all possible mine impacts such as tailing pond failures.

5. Provide better documentation for the Magee rapid FA model, including any prior publications that validate the functional equations, and any plans in the future to validate the method. Provide better linkage between this rapid HGM Method and the already completed intensive HGM guidebooks for Alaska.

## Literature Cited

- Adamus, P., J. Morlan, and K. Verble. 2010. Manual for the Oregon Rapid Wetland Assessment Protocol (ORWAP). Version 2.0.2. Oregon Dept. of State Lands, Salem, OR.
- Alaska Department of Fish and Game (ADF&G). 2013. Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes. Alaska Department of Fish and Game, Juneau, Alaska.
- Brinson, M.M. 1993. A Hydrogeomorphic Classification for Wetlands. Wetlands Research Program Technical Report WRP-DE-4. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi.
- Cole, Charles Andrew. 2006. HGM and wetland functional assessment: Six degrees of separation from the data? Ecological Indicators 6:485-493.
- Federal Aviation Administration [FAA]. 2007. Juneau International Airport Final EIS and Section 4(f) Evaluation. Appendix E: Wetland Functional Assessment Technical Report.
- Fennessy, M.S., A.D. Jacobs, and M.E. Kentula. 2007. An evaluation of rapid methods for assessing the ecological condition of wetlands. Wetlands 27:543–560.
- Hall, Jon; Jim Powell, Stan Carrick, Ted Rockwell, Garry Hollands, Todd Walter, and Joe White. 2003. Wetland Functional Assessment Guidebook: Operational Draft Guidebook for Assessing the Functions of Slope/Flat Wetland Complexes in the Cook Inlet Basin Ecoregion, Alaska, using the HGM Approach. Developed for: State of Alaska Department of Environmental Conservation, Juneau, Alaska. 172 pp.
- Kittel, G. and D. Faber-Langendoen. 2011. Watershed Approach to Wetland Mitigation: A Conceptual Framework for Juneau, Alaska. Prepared by NatureServe, Arlington VA.
- Lee, L.C., M.C. Rains, J.L. Cassin, S.R. Stewart, R. Post, M. Brinson, M. Clark, J.V. Hall, G. Hollands, D. LaPlant, W. Nutter, J. Powell, T. Rockwell, D. Whigham, and W. Kleindl. 1999. Operational Draft Guidebook for Reference Based Assessment of the Functions of Precipitation-Driven Wetlands on Discontinuous Permafrost in Interior Alaska, State of Alaska Department of Environmental Conservation. Juneau, Alaska.
- Magee, D.W. and G. G. Hollands. 1998. A Rapid Procedure for Assessing Wetland Functional Capacity: Based on Hydrogeomorphic (HGM) Classification. Normandeau Associates, Bedford NH and ENSR, Northboro, Massachusetts.
- Powell, J. E., D'Amore, D. V., Thompson, R., Huberth P., Bigelow, B., Walter, M. T., and Brock, T. 2003. Wetland Functional Assessment Guidebook, Operational Draft Guidebook for Assessing the Functions for Riverine and Slope River Proximal Wetlands in Coastal Southeast and South central Alaska Using the HGM Approach. State of Alaska Department of

Environmental Conservation. U.S. Army Corps of Engineers Waterways Experiment Station Technical Report.

Smith, R. Daniel, Aland Ammann, Candy Baroldus, and Mark M. Brinson. 1995. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, References Wetlands, and Functional Indices. U.S. Army Corps of Engineers Waterways Experiment Station Technical Report. WRP-DE-9

Stevenson, R.J., and F.R. Hauer. 2002. Integrating Hydrogeomorphic and Index of Biotic Integrity approaches for environmental assessment of wetlands. Journal of North American Benthological Society 21: 502-513.

Three Parameters Plus, INC [3PPI]. 2014. DRAFT Wetland Functional Assessment Donlin Gold Project Version 02, Revision 01. Draft Reports volumes 1 and 2, appendixes A-F, 1101 pages.

Tiner, Ralph. W. 2005. Assessing Cumulative Loss of Wetland Functions in the Naticoke River Watershed Using Enhanced National Wetlands Inventory Data. Wetlands, vol 25, no 2. Pp 405-419.

Turner, R. Eugene, Ann M. Redmond and Joy B. Zedler. 2001. Count it by Acre or Function—Mitigation Adds up to Net Loss of Wetlands. National Wetlands Newsletter, vol 23, no 6.

U.S. Code of Federal Regulations [USCFR]. 2013. 40 CFR CH1 (7-1-13 edition) Title 40—Protection of Environment. Section 404(b)(1) guidelines for specification of disposal sites for dredged or fill material. Sections 40CFR230.10(a) and 40CFR230.10(a)(3).

Zedler, J. 2005. How compatible are biodiversity and ecosystem service goals? National Wetlands Newsletter 27:1.